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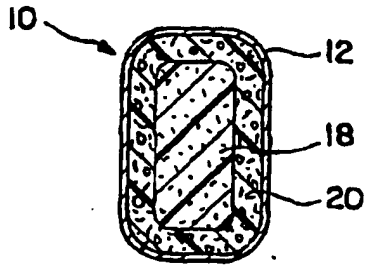
(54) Title: THREE DIMENSIONAL LAMINATE BEAM STRUCTURE



(57) Abstract

A three-dimensional laminate beam (10) is formed by inserting a preformed foam core (18) insert within a hydra-formed metal section (12) having curved three-dimensional geometry. A reinforcing polymer (20) is pumped in and around the foam core insert so as to be adjacent the inside wall of the shell. The polymer bonds to the inside wall of the shell upon the polymer being cured.

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core insert so that after curing the polymer bonds to the inside wall of the structure.

In a preferred practice of the invention the structure is a hydra-formed metal section, such as a vehicle control arm assembly. The pre-shaped foam insert is preferably made of a lightweight material to minimize the weight of the final laminate beam formed by the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a laminated control arm assembly beam in accordance with this invention; and

Figure 2 is a cross-sectional view taken through Figure 1 along the line 2-2.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is particularly useful for reinforcing hollow sections or structures, which are of curved geometry and/or located at locations, which are relatively inaccessible.

In the preferred practice of the invention the hollow structure is a metal section, such as a hydra-formed metal section with curved three-dimensional geometry. An example of such section is a control arm assembly, wherein it is desired to reinforce the control arm beam. For such hydra-formed section the critical portion which requires reinforcement in order to maximize the overall performance of the component is often the portion at a major section discontinuity "notch" or curvature. Figure 1, for example,

09/103,031 filed June 23, 1998, all of the details of that patent and application are incorporated herein by reference thereto.

The curing of the polymer could be accomplished in any suitable manner. For example, where the shell 12 is a vehicle component, the polymer could be heat cured in an oven such as an e-coat oven during the manufacturing of the vehicle. Alternatively, the polymer could be cured at ambient temperatures such as, for example, about 77°F.

The foam core insert 18 may be pre-shaped in a geometry which generally conforms to the inner surface of shell 12 thereby minimizing the amount of polymer material required to fill the remaining open space within shell 12. Alternatively, core insert 18 may be of uniform cross-sectional shape throughout all or most of its length to simplify the structure of the core insert, but which would result in a greater amount of open space. The foam core insert 18 thus comprises a three-dimensional or essentially two dimensional molded pre-formed part which occupies some of the volume or space within shell 12 and provides a substrate for the polymer 20 which is pumped into the shell 12.

The invention thus results in a three-dimensional laminate beam, which is formed by pumping the polymer around the pre-molded foam core. This is the only means necessary to reinforce such a hydra-formed metal section.

10. The beam of claim 3 wherein said polymer is ambient temperature curable.

11. A method of forming a three-dimensional laminate beam comprising the steps of inserting a pre-formed core insert within a hollow shell with the insert spaced from at least one inside wall of the shell and with the shell being of curved shape, pumping a reinforcing polymer in and around the core insert, and curing the polymer to cause the polymer to bond to the inside wall of the shell.

12. The method of claim 11 including pre-molding the core insert from a lightweight foam material.

13. The method of claim 12 wherein the shell is made of a hydra-formed metal section of non-uniform shape along its length.

14. The method of claim 12 wherein the resulting beam is a vehicle control arm assembly.

15. The method of claim 13 wherein the resulting beam is a vehicle component.

16. The method of claim 15 wherein the polymer is heat cured.

17. The method of claim 15 wherein the polymer expands upon curing.

18. The method of claim 15 wherein the polymer is cured at ambient temperatures.

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B62D 29/00
US CL :Please See Extra Sheet.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : Please See Extra Sheet.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	US 5,806,919 A (DAVIES) 15 SEPTEMBER 1998 (15/09/98), SEE ENTIRE DOCUMENT, ESPECIALLY FIGURES 1-2.	1-10
X,P	US 5,866,052 A (MURAMATSU) 02 FEBRUARY 1999 (02/02/99), SEE ENTIRE DOCUMENT, ESPECIALLY FIGURE 6(C).	1-10
X	US 4,722,563 A (LOREN ET AL.) 02 FEBRUARY 1988 (02/02/88), SEE ENTIRE DOCUMENT, ESPECIALLY FIGURE 11.	1-3, 7-12, 14-18
X	US 5,575,526 A (WYCECH) 19 NOVEMBER 1996 (19/11/96), SEE ENTIRE DOCUMENT, ESPECIALLY FIGURE 11.	1, 11, 13

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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